U.S. Department of Transportation
National Highway Traffic Safety Administration

ODI RESUME

Investigation: EA 01-015
Prompted By: PE01-008
Date Opened: 08/09/2001 Date Closed: 04/24/2003
Principal Investigator: PETER ONG
Subject: PASSENGER AIR BAG-RELATED FACIAL/EYE INJURIES

Manufacturer: NISSAN NORTH AMERICA, INC.
Products: NISSAN ALTIMA 1994-1995 (BUILT PRIOR TO MARCH 2, 1995)
Population: 248,638

Problem Description: The passenger air bag may cause facial and eye injuries during crashes.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	12	75	79*
Crashes/Fires:	12	75	79
Injury Incidents:	12	75	79
# Injuries:	12	75	79
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other:	0	0	0

* Excludes 8 ODI/Mfr duplicate reports

Action: THIS ENGINEERING ANALYSIS HAS BEEN CLOSED (NHTSA RECALL NO. 03V-150).

Engineer: Peter C. Ong Date: 4/24/03
Div Chf: Thomas Gorgen Date: 4/24/03
Ofc Dir: Date: 4/24/03

Summary: By letter dated April 11, 2003, Nissan notified NHTSA it will conduct a campaign to replace the passenger air bag module with a "depowered" air bag module in model year 1994 - early 1995 (built prior to March 2, 1995) Nissan Altima vehicles. The replacement module will be provided at no charge to owners. The "depowered" air bag should reduce the overall risk of air bag deployment-related injuries.

The air bag replacement campaign to be conducted by Nissan, which will enhance safety and be monitored by NHTSA, sufficiently addresses the safety concerns raised by this investigation. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that no safety-related defect exists. The agency will take further action if warranted by the circumstances.

Background: ODI opened the Preliminary Evaluation (PE01-008) on March 13, 2001, based on five consumer complaints of alleged passenger air bag-related facial or eye injuries in crashes involving model year (MY) 1994 and early-MY 1995 Altima vehicles (subject vehicles) manufactured by Nissan North America (Nissan). In addition, ODI received information from a plaintiff's lawyer concerning 24 other incidents in which there were allegations that a passenger received similar injuries in a subject vehicle. ODI sent Information Request letters (IRs) to Nissan and to 10 other manufacturers during the PE. ODI upgraded the investigation to an Engineering Analysis (EA01-015) on August 9, 2001, to further analyze the issue and to obtain further injury and air bag module information.

Nissan manufactured approximately 249,000 subject vehicles. The MY 1994 Nissan Altima was among the first high-population passenger vehicles in its class (compact sedan) to have frontal passenger air bags as standard equipment. Many other manufacturers introduced a passenger air bag as standard equipment in their 1995 models. For the passenger side of the MY 1994 Altima, Nissan used the inflator module used in the MY 1993 Infiniti G20 vehicle. The air bag module was manufactured by Takata Corporation Inc. (Takata). The Altima passenger bag is a relatively large-volume bag that does not have a tether. The fold pattern is mainly a roll pattern with a few accordion folds at the base near the inflator module opening. The unit is top-mounted in the instrument panel and produces a deployment profile that tracks along the windshield surface and then rearward.

Nissan revised the Altima passenger air bag module midway through the 1995 model year (MY 1995.5 Altima), while maintaining the Altima's basic design, chassis, interior seat and dimensions. The MY 1995.5 Altima passenger air bag module contains a different inflator than the MY 1994-1995 Altima and the bag volume is smaller. The fold pattern was also changed from a roll style to a full accordion style method. Neither air bag has a tether. The two modules are not interchangeable.

Complaint and Injury Data: During this EA, ODI sent IRs to Nissan, to 11 other vehicle manufacturers, and to Takata, requesting complaint, injury, and other information. ODI also searched NHTSA's consumer database system for relevant reports. ODI analyzed all of the reports for specific injury location and severity. It also reviewed police accident/crash reports (PARs), medical records, photographs, and other supporting data.

> Subject Vehicle Complaints and Injuries - In response to the IRs, Nissan submitted information on 88 reports of owner complaints, legal claims and lawsuits. ODI received four additional non-duplicate reports. ODI concluded that 79 of the 92 total reports concerned facial or eye injuries that allegedly were caused by the deployment of the passenger air bag, and that the injuries discussed in the other 13 reports were to other body regions. Many (66 of the 79) facial or eye injury reports were contained in legal claims and lawsuits.
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> Because facial and eye-surface abrasion injuries frequently are minor in nature and do not lead to permanent impairment, ODI's investigation focused on eye injuries that reportedly led to permanent visual impairment or loss of vision. Using criteria developed

at the Impact Biomechanics Laboratory,[1] Virginia Tech University, ODI classified 37 reports as involving moderate-to-severe eye injuries. The 22 eye injuries that ODI classified as moderate range from corneal and retinal contusion/ lacerations to orbital fractures. The 15 eye injuries that ODI classified as severe include retinal detachments, globe ruptures, and/or eye avulsions that reportedly led to permanent impairment or full loss of vision in at least one eye.

There are varying amounts of information in the 37 reports concerning occupant and crash conditions prior to impact. From those reports containing enough details, the data indicate that most of the injured passengers were small-stature females (or adolescents), most seats were in the midway position, and most crashes involved vehicle braking before impact. Most of the injured passengers alleged that they were wearing their safety belts, but that is an issue in considerable dispute.

Other Vehicle Complaints and Injuries - In response to the IRs, manufacturers provided information about facial or eye injuries that allegedly occurred in crashes involving 20 other passenger car models that are relatively similar to the Altima, representing approximately four million vehicles manufactured in MY 1994-1996. The responses included 176 reports, of which 100 involved facial or eye injuries that allegedly were due to the deployment of a passenger air bag. Again, a large number of the reports (81 of 100) of facial or eye injuries were contained in legal claims and lawsuits. ODI concluded after a detailed review that only two (2) of the 100 reports involved moderate-to-severe eye injuries. The other 98 reports were about facial injuries (facial/eye lid abrasion, bruises or cuts) or minor eye injuries (corneal abrasion or bleeding) that did not lead to permanent vision impairment.

For the 336,000 MY 1995.5-1997 Nissan Altima vehicles with the revised air bag module, Nissan provided 24 facial or eye injury reports. Using the same criteria identified above, ODI concluded that 17 of the 24 reports indicate facial injuries and three of the 24 reports indicate minor eye injuries. There was not enough information/data to make an injury severity assessment on the four remaining reports.

The design of the passenger air bag module in the MY 1993-1996 Infiniti G20 is the same as the module in the subject Altima vehicles. However, the G20's chassis, instrument panel design/angle, windshield angle, air bag sensor supplier, and air bag module assembler are different from those for the subject vehicles. There are no reports of moderate-to-severe eye injuries due to passenger air bag deployments in MY 1993-96 Infiniti G20 vehicles.

Air Bag Module Inspection: ODI received six un-deployed air bag modules from Nissan. The six modules were service replacement parts from inventory stock and have never been deployed. When ODI unfolded, examined and measured these air bag modules, they did not fully match the

[1] S. Duma, et al.: "Airbag-Induced Eye Injuries: A Report of 25 Cases." The Journal of Trauma: Injury, Infection, and Critical Care (1996).

drawings that Nissan had submitted to ODI. Specifically, five of six air bag cushions had a "reverse end roll" fold pattern near the rear most tip of the cushion, and two air bag cushions had other deviations from the drawings. The extent of the deviations varied from module to module.

Nissan's Position:[2] In its submissions and presentations to ODI, Nissan argued that "The early Altima air bag design and performance were state-of-the-art for MY 1994-1995 passenger air bags." Nissan stated that in terms of peak pressure, pressure rise rate, air bag volume, inflation time, and excursion, the early Altima passenger air bag had values that were "well within the range of other passenger side air bags."[3]

In addition, Nissan argued, based primarily on information from the New York and other crash databases that the passengers in subject vehicles are no more likely than passengers in peer vehicles to suffer face or eye injuries when the passenger air bag deploys in a low-to-moderate speed crash.[4] Nissan notes that numerous eye and face injuries appear in the NY state database that were not identified in the IR responses of the manufacturers, and claims that this indicates that there are many such incidents that are not reported to the companies. Nissan contends that the higher claim rate for the subject vehicles is merely the result of external litigation interests and does not reflect the existence of more real world injuries.

Nissan also denied that the passenger air bag cushion or fabric alone have caused the eye injuries that front seat passengers have sustained. Nissan asserted that a number of persons with eye injuries associated with the deployment of a passenger air bag in a subject vehicles were "out of position." In litigation, Nissan has vigorously contested plaintiffs' claims regarding position, belt use, and other issues. Finally, Nissan pointed out that most of the negative information about the performance of the passenger air bags in the subject vehicles was provided to ODI by a single product liability lawyer who represents plaintiffs in lawsuits against Nissan.

Takata's Position: In response to the fold variations observed by ODI, the air bag supplier, Takata, stated in its IR response that they were due to "manufacturing variation" and that "these alleged differences do not substantially affect the nominal restraint performance of the passenger airbag module." In addition, Takata presented the results from a series of deployment tests it had conducted on the air bag utilized in the subject vehicles. According to Takata, the purpose was to "evaluate the effect of manufacturing variation." Six tests were conducted (three of these tests were with nominal folds and three with "reverse end roll" folds). Based on maximum rearward displacement and the leading edge velocity at the rearward most position, Takata asserted that the "differences in deployment characteristics between the nominally folded cushions and cushions...[with] reverse end roll variation are insignificant and well within the expected variation of this type of evaluation."

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[2] An enclosure to a letter to the agency dated April 11, 2003 sets forth a detailed presentation of Nissan's position. A copy of that letter and its enclosures are included in the public file for this investigation.

[3] Nissan based those statements on its analysis of a report by J. Hinch, et al.: "Air Bag Technology in Light Passenger Vehicles." Office of Research and Development, NHTSA, Rev 1 (1999).

[4] Although most state police accident reports (PARs) do not contain a separate face or eye injury category, the New York State PAR has both face and eye injury categories, and NY State data includes information derived from those PARs.

ODI's Analysis: Although Nissan contends that there may be a substantial number of air bag-induced eye injuries that are not reported to vehicle manufacturers, it is undisputed that there have been far more claims identifying moderate-to-serious eye injuries allegedly due to air bag deployments in the subject vehicles than in similar peer vehicles. We have significant doubts about Nissan's assertion that the preponderance of claims involving the subject vehicles does not reflect the true incidence of moderate-to-severe eye injuries associated with air bag deployments in those vehicles, but rather is the result of a conscious decision by a plaintiff's attorney to focus on the subject vehicles.

NHTSA's National Center for Statistical Analysis (NCSA) confirmed Nissan's assertion that the data from the New York State PARs database did not show a greater incidence of face or eye injuries in subject vehicles than in 15 other peer vehicles. However, this data is based on on-scene observations by law enforcement personnel, and serious eye injuries that are internal are difficult to detect. Therefore, in order to further analyze this data, NCSA used the New York State Crash Outcome Data Evaluation System (CODES) to correlate PARs and hospital records. NCSA reviewed the hospital records of occupants of the subject vehicles and the peer vehicles identified by Nissan. None of 156 PAR-identified face or eye injuries resulted in hospital attention or treatment for the moderate-to-serious type of eye injuries described in earlier sections of this report. In addition, analysis of other States' crash data and CODES also showed that moderate-to-serious eye injuries in automobile crashes (based on hospital records) are very low occurrence events. For these reasons, statistical conclusions about the relative likelihood of serious eye injuries in different vehicles cannot be drawn from state crash or CODES data.

While cognizant of Nissan's asserted distinction between real world events and claims, we note that the claims experience of the subject vehicles is substantially different from its peers. Of particular note is the low or nonexistent claims experience of two other similar Nissan products: the Altima vehicles built after mid-model year 1995 (which have a redesigned air bag) and the MY 1993-1996 Infiniti G-20 (which has an air bag of the same nominal design but which was manufactured in Japan rather than in the United States and which has a different vehicle architecture).

We have not identified a particular element of the subject vehicles' air bag design that has led to the disproportionate number of claims of moderate-to-severe eye injuries arising from the deployment of these airbags. However, the performance of the air bag systems in the subject vehicles appears to have resulted in the relatively high occurrence of such injuries. We would not have closed this investigation in the absence of an action that addresses our safety concerns.

Manufacturer Action: By letter dated April 11, 2003, Nissan informed NHTSA that it will conduct a campaign under which it will offer a replacement air bag, free of charge, to all owners of the subject vehicles. The company intends to begin this campaign shortly, and it will file with the agency the reports associated with safety recalls. According to Nissan, the replacement air bag will be a depowered air bag that differs from the original air bag in several respects. The replacement module has a different inflator type, and there is less inflator power. The air bag

volume is also reduced, and it has a different bag shape, excursion length, and fold pattern compared to the original air bag.

Conclusion: ODI has concluded that the air bag replacement campaign to be conducted by Nissan, which will enhance safety and be monitored by NHTSA, sufficiently addresses the safety concerns raised by this investigation. The replacement air bags are different in many material ways from the original air bags in the subject vehicles. These differences should improve the overall performance of these air bag systems in a crash and reduce the likelihood of moderate and severe air bag-induced injury. Accordingly, we are closing this investigation. The closing of this investigation does not constitute a finding that no safety defect exists. The agency reserves the right to take further action if warranted by the circumstances.